

An Evaluation of Antarctica as a Calibration Target for Passive Microwave Satellite Missions with Climate Data Record Applications

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Passive microwave remote sensing at L-band (1.4 GHz) is sensitive to soil moisture and sea surface salinity, both important climate variables. Science studies involving these variables can now take advantage of new satellite L-band observations. The first mission with regular global passive microwave observations at L-band is the European Space Agency's Soil Moisture and Ocean Salinity (SMOS), launched November, 2009. A second mission, NASA's Aquarius, was launched June, 2011. A third mission, NASA's Soil Moisture Active Passive (SMAP) is scheduled to launch in 2014. Together, these three missions may provide a decade-long data record—provided that they are intercalibrated. The intercalibration is best performed at the radiance (brightness temperature) level, and Antarctica is proving to be a key calibration target. However, Antarctica has thus far not been fully characterized as a potential target.

This paper will present evaluations of Antarctica as a microwave calibration target for the above satellite missions. Preliminary analyses have identified likely target areas, such as the vicinity of Dome-C and larger areas within East Antarctica. Physical sources of temporal and spatial variability of polar firn are key to assessing calibration uncertainty. These sources include spatial variability of accumulation rate, compaction, surface characteristics (dunes, micro-topography), wind patterns, and vertical profiles of density and temperature. Using primarily SMOS data, variability is being empirically characterized and attempts are being made to attribute observed variability to physical sources. One expected outcome of these studies is the potential discovery of techniques for remotely sensing--over all of Antarctica—parameters such as surface temperature.